

New Hampshire Volunteer Lake Assessment Program

2003 Interim Report for Dutchman Pond Springfield



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Water Division
Watershed Management Bureau
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OBSERVATIONS & RECOMMENDATIONS

After reviewing data collected from **DUTCHMAN POND, SPRINGFIELD**, the program coordinators have made the following observations and recommendations:

As part of the state's lake survey program, DES biologists performed a comprehensive lake survey on **DUTCHMAN POND** this summer. Publicly-owned recreational lakes/ponds in the state are surveyed approximately every ten to fifteen years. In addition to the tests normally carried out by VLAP, biologists tested for certain indicator metals and nitrogen, created a map of the pond bottom contours (referred to as a bathymetric map), and mapped the abundance and distribution of the aquatic plants along the shoreline. DES biologists will also sample the pond once during the Winter of 2003-2004. Some data from this lake survey have been included in this report and has been added to the historical database for your pond. If you would like a complete copy of the raw data from the lake survey, please contact the DES Limnology Center at (603) 271-3414 or (603) 271- 2658. A final report should be available in 2005 and a copy will be available at any state library.

FIGURE INTERPRETATION

- **Figure 1 and Table 1:** The graphs in Figure 1 (Appendix A) show the historical and current year chlorophyll-a concentration in the water column. Table 1 (Appendix B) lists the maximum, minimum, and mean concentration for each sampling season that the pond has been monitored through the program.

Chlorophyll-a, a pigment naturally found in plants, is an indicator of the algal abundance. Because algae are usually microscopic plants that contain chlorophyll-a, and are naturally found in lake ecosystems, the chlorophyll-a concentration measured in the water gives an estimation of the algal concentration or lake productivity. **The mean (average) summer chlorophyll-a concentration for New Hampshire's lakes and ponds is 7.02 ug/L.**

The current year data (the top graph) show that the chlorophyll-a concentration **decreased** from July to August. The chlorophyll-a concentration on both sampling events was ***much less than*** the state mean.

Overall, visual inspection of the historical data trend line (the bottom graph) shows a **stable** in-lake chlorophyll-a trend. Specifically, the annual mean chlorophyll has ranged between approximately 1 and 2 mg/L since monitoring began in 2003. In the 2004 annual report we will conduct a statistical analysis of the historic data to objectively determine if there has been a significant change in the annual mean chlorophyll-a concentration since monitoring began.

While algae are naturally present in all lakes/ponds, an excessive or increasing amount of any type is not welcomed. In freshwater lakes/ponds, phosphorus is the nutrient that algae depend upon for growth. Algal concentrations may increase with an increase in nonpoint sources of phosphorus loading from the watershed, or in-lake sources of phosphorus loading (such as phosphorus releases from the sediments). Therefore, it is extremely important for volunteer monitors to continually educate residents about how activities within the watershed can affect phosphorus loading and pond quality.

- **Figure 2 and Table 3:** The graphs in Figure 2 (Appendix A) show historical and current year data for pond transparency. Table 3 (Appendix B) lists the maximum, minimum and mean transparency data for each sampling season that the pond has been monitored through the program.

Volunteer monitors use the Secchi-disk, a 20 cm disk with alternating black and white quadrants, to measure water clarity (how far a person can see into the water). Transparency, a measure of water clarity, can be affected by the amount of algae and sediment from erosion, as well as the natural colors of the water. **The mean (average) summer transparency for New Hampshire's lakes and ponds is 3.7 meters.**

The current year data (the top graph) show that the in-lake transparency ***increased very slightly*** from July to August.

Overall, visual inspection of the historical data trend line (the bottom graph) shows a **very stable** trend for in-lake transparency. Specifically, since monitoring began, the annual mean transparency has ranged between approximately 2.5 and 3.0 meters. As discussed previously, in the 2004 annual report, we will conduct a statistical analysis of the historic data to objectively determine if there has been

a significant change in the annual mean transparency since monitoring began.

Typically, high intensity rainfall causes erosion of sediments into lakes/ponds and streams, thus decreasing clarity. Efforts should continually be made to stabilize stream banks, pond shorelines, disturbed soils within the watershed, and especially dirt roads located immediately adjacent to the edge of tributaries and the pond. Guides to Best Management Practices designed to reduce, and possibly even eliminate, nonpoint source pollutants, such as sediment loading, are available from DES upon request.

- **Figure 3 and Table 8:** The graphs in Figure 3 (Appendix A) show the amounts of phosphorus in the epilimnion (the upper layer) and the hypolimnion (the lower layer); the inset graphs show current year data. Table 8 (Appendix B) lists the annual maximum, minimum, and median concentration for each deep spot layer and each tributary since the pond has joined the program.

Phosphorus is the limiting nutrient for plant and algae growth in New Hampshire's freshwater lakes and ponds. Too much phosphorus in a pond can lead to increases in plant and algal growth over time. **The median summer total phosphorus concentration in the epilimnion (upper layer) of New Hampshire's lakes and ponds is 11 ug/L. The median summer phosphorus concentration in the hypolimnion (lower layer) is 14 ug/L.**

The current year data for the epilimnion (the top inset graph) and the hypolimnion (the bottom graph) show that the phosphorus concentration **decreased** from July to August. The phosphorus concentration on both sampling events was **less than** the state median.

Overall, visual inspection of the historical data trend line for the epilimnion shows a **stabilizing** phosphorus trend, which is **less than** the state median. We hope this trend continues.

Overall, visual inspection of the historical data trend line for the hypolimnion shows **a slightly decreasing (meaning slightly worsening)** phosphorus trend.

One of the most important approaches to reducing phosphorus loading to a waterbody is to continually educate watershed residents about its sources and how excessive amounts can adversely impact the ecology and value of lakes and ponds. Phosphorus sources within a lake or pond's watershed typically include septic systems, animal

waste, lawn fertilizer, road and construction erosion, and natural wetlands.

TABLE INTERPRETATION

➤ **Table 2: Phytoplankton**

Table 2 (Appendix B) lists the current and historic phytoplankton species observed in the pond. The dominant phytoplankton species observed this year were **Anabaena** and **Microcystis**, which are both species of **cyanobacteria**. While these species were dominant in the plankton sample, they were not abundant. This means that there is not a high concentration of algal cells in the water column, which indicates that the overall productivity of the lake is relatively low.

An overabundance of cyanobacteria (previously referred to as blue-green algae) indicates that there may be an excessive total phosphorus concentration in the pond, or that the ecology is out of balance. ***Anabaena and Microcystis, if present in large amounts, can be toxic to livestock, wildlife, pets, and humans.***

Cyanobacteria can reach nuisance levels when excessive nutrients and favorable environmental conditions occur. During September of 2003, a few lakes and ponds in the southern portion of the state experienced cyanobacteria blooms. This was likely due to nutrient loading to these waterbodies. As mentioned previously, many weeks during the Spring and Summer of 2003 were rainy, which likely resulted in a large amount of nutrient loading to surface waters.

The presence of cyanobacteria serves as a reminder of the pond's delicate balance. Watershed residents should continue to act proactively to reduce nutrient loading into the pond by eliminating fertilizer use on lawns, keeping the pond shoreline natural, re-vegetating cleared areas within the watershed, and properly maintaining septic systems and roads.

In addition, residents should also observe the pond in September and October during the time of fall turnover (lake mixing) to document any algal blooms that may occur. Cyanobacteria (blue-green algae) have the ability to regulate their depth in the water column by producing or releasing gas from vesicles. However, occasionally lake mixing can affect their buoyancy and cause them to rise to the surface and bloom. Wind and currents tend to "pile" cyanobacteria into scums that accumulate in one section of the pond. If a fall bloom occurs, please contact the VLAP Coordinator.

➤ **Table 4: pH**

Table 4 (Appendix B) presents the in-lake and tributary current year and historical pH data.

pH is measured on a logarithmic scale of 0 (acidic) to 14 (basic). pH is important to the survival and reproduction of fish and other aquatic life. A pH below 5.5 severely limits the growth and reproduction of fish. A pH between 6.5 and 7.0 is ideal for fish. The mean pH value for the epilimnion (upper layer) in New Hampshire's lakes and ponds is **6.5**, which indicates that the surface waters in state are slightly acidic. For a more detailed explanation regarding pH, please refer to the "Chemical Monitoring Parameters" section of this report.

The mean pH at the deep spot this season ranged from **6.18** in the hypolimnion to **6.28** in the epilimnion, which means that the water is **slightly acidic**.

Due to the presence of granite bedrock in the state and the deposition of acid rain, there is not much that can be done to effectively increase pond pH.

➤ **Table 5: Acid Neutralizing Capacity**

Table 5 (Appendix B) presents the current year and historic epilimnetic ANC for each year the pond has been monitored through VLAP.

Buffering capacity or ANC describes the ability of a solution to resist changes in pH by neutralizing the acidic input to the lake. The mean ANC value for New Hampshire's lakes and ponds is **6.7 mg/L**, which indicates that many lakes and ponds in the state are "highly sensitive" to acidic inputs. For a more detailed explanation, please refer to the "Chemical Monitoring Parameters" section of this report.

The Acid Neutralizing Capacity (ANC) of the epilimnion (the upper layer) continued to remain ***much less than*** the state mean. Specifically, the mean ANC this season was **2.45 mg/L** which indicates that the pond is ***critically sensitive*** to acidic inputs (such as acid precipitation).

➤ **Table 6: Conductivity**

Table 6 (Appendix B) presents the current and historic conductivity values for tributaries and in-lake data. Conductivity is the numerical expression of the ability of water to carry an electric current. The mean conductivity value for New Hampshire's lakes and ponds is

62.1 uMhos/cm. For a more detailed explanation, please refer to the “Chemical Monitoring Parameters” section of this report.

The conductivity in the pond continued to be **very low** this season. Specifically, the mean annual conductivity of the epilimnion has ranged between approximately **18 and 22 uMhos/cm** since monitoring began in 1989. The low conductivity level in the pond is an indication of the low amount of pollutants in the watershed. We hope this trend continues!

➤ **Table 8: Total Phosphorus**

Table 8 (Appendix B) presents the current year and historic total phosphorus data for in-lake and tributary stations. Phosphorus is the nutrient that limits the algae’s ability to grow and reproduce. Please refer to the “Chemical Monitoring Parameters” section of this report for a more detailed explanation.

The pond is primarily groundwater-fed; therefore, there are no major tributaries to sample.

➤ **Table 9 and Table 10: Dissolved Oxygen and Temperature Data**

Table 9 (Appendix B) shows the dissolved oxygen/temperature profile(s) for the 2003 sampling season. Table 10 (Appendix B) shows the historical and current year dissolved oxygen concentration in the hypolimnion (lower layer). The presence of dissolved oxygen is vital to fish and amphibians in the water column and also to bottom-dwelling organisms. Please refer to the “Chemical Monitoring Parameters” section of this report for a more detailed explanation.

The dissolved oxygen concentration was **high** at all depths sampled at the deep spot of the pond. Typically, shallow lakes and ponds that are not deep enough to stratify into more than one or two layers will have relatively high amounts of oxygen at all depths. This is due to continual lake mixing and diffusion of oxygen into the bottom waters induced by wind and wave action.

➤ **Table 11: Turbidity**

Table 11 (Appendix B) lists the current year and historic data for in-lake and tributary turbidity. Turbidity in the water is caused by suspended matter, such as clay, silt, and algae. Water clarity is strongly influenced by turbidity. Please refer to the “Other Monitoring Parameters” section of this report for a more detailed explanation.

The turbidity of the samples continued to be **low** this season. We hope this trend continues!

➤ **Table 12: Bacteria (*E.coli*)**

Table 12 lists the current year data for bacteria (*E.coli*) testing. *E. coli* is a normal bacterium found in the large intestine of humans and other warm-blooded animals. *E.coli* is used as an indicator organism because it is easily cultured and its presence in the water, in defined amounts, indicates that sewage **MAY** be present. If sewage is present in the water, potentially harmful disease-causing organisms may also be present.

The *E.coli* concentration was **low** at each of the sites tested this season. Specifically, results were **10 counts per 100 mL or fewer**. We hope this trend continues!

If you are particularly concerned about bacteria levels in typical swimming locations, we recommend that your monitoring group conduct *E.coli* testing next season on a weekend during heavy beach use or after a rain event. Since *E.coli* die quickly in cool pond waters, testing is most accurate and most representative of the health risk to bathers when the source (humans, animals, or waterfowl) is present.

DATA QUALITY ASSURANCE AND CONTROL

Annual Assessment Audit:

During the annual visit to your pond, the biologist conducted a “Sampling Procedures Assessment Audit” for your monitoring group. Specifically, the biologist observed the performance of your monitoring group while sampling and filled out an assessment audit sheet to document the ability of the volunteer monitors to follow the proper field sampling procedures (as outlined in the VLAP Monitor’s Field Manual). This assessment is used to identify any aspects of sample collection in which volunteer monitors are not following the proper procedures, and also provides an opportunity for the biologist to retrain the volunteer monitors as necessary. This will ultimately ensure that the samples that the volunteer monitors collect are truly representative of actual lake and tributary conditions.

Overall, your monitoring group did an **excellent** job collecting samples on the annual biologist visit this season! Specifically, the members of your monitoring group followed the proper field sampling procedures and there was no need for the biologist to provide additional training. Keep up the good work!

Sample Receipt Checklist:

Each time your monitoring group dropped off samples at the laboratory this summer, the laboratory staff completed a sample receipt checklist to assess and document if the volunteer monitors followed proper sampling techniques when collecting the samples. The purpose of the sample receipt checklist is to minimize, and hopefully eliminate, future re-occurrences of improper sampling techniques.

Overall, the sample receipt checklist showed that your monitoring group did a **very good** job when collecting samples this season! Specifically, the members of your monitoring group followed the majority of the proper field sampling procedures when collecting and submitting samples to the laboratory. However, the laboratory did identify one aspect of sample collection that the volunteer monitors could improve upon.

- **Sample Volume:** Please remember to fill *E.coli* bottles so that no air bubbles are present in the bottle. This will ensure that the sample is not contaminated.

USEFUL RESOURCES

Acid Deposition Impacting New Hampshire's Ecosystems, ARD-32, NHDES Fact Sheet, (603) 271-3505, or www.des.state.nh.us/factsheets/ard/ard-32.htm.

Best Management Practices to Control Nonpoint Source Pollution: A Guide for Citizens and Town Officials, NHDES-WD 97-8, NHDES Booklet, (603) 271-3503.

Camp Road Maintenance Manual: A Guide for Landowners. Kennebec Soil and Water Conservation District, 1992, (207) 287-3901.

Comprehensive Shoreland Protection Act, RSA 483-B, WD-SP-5, NHDES Fact Sheet, (603) 271-3503 or www.des.state.nh.us/factsheets/sp/sp-5.htm.

Cyanobacteria in New Hampshire Waters Potential Dangers of Blue-Green Algae Blooms, NHDES Fact Sheet, (603) 271-3505, or www.des.state.nh.us/factsheets/wmb/wmb-10.htm.

Erosion Control for Construction in the Protected Shoreland Buffer Zone, WD-SP-1, NHDES Fact Sheet, (603) 271-3503 or www.des.state.nh.us/factsheets/sp/sp-1.htm.

Impacts of Development Upon Stormwater Runoff, WD-WQE-7, NHDES Fact Sheet, (603) 271-3503, or www.des.state.nh.us/factsheets/wqe/wqe-7.htm.

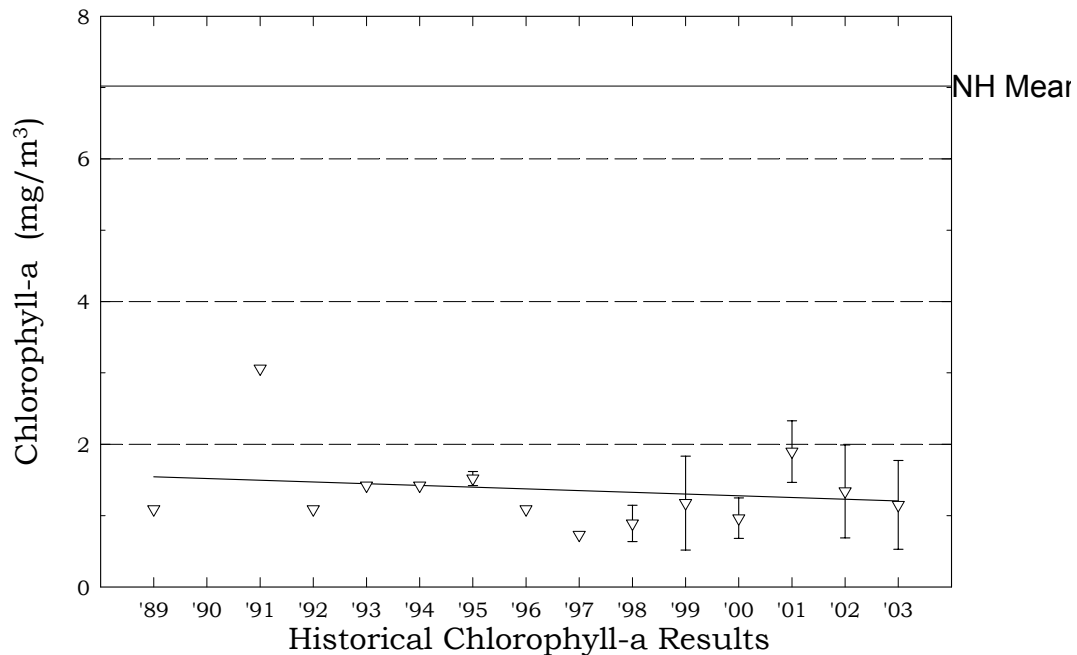
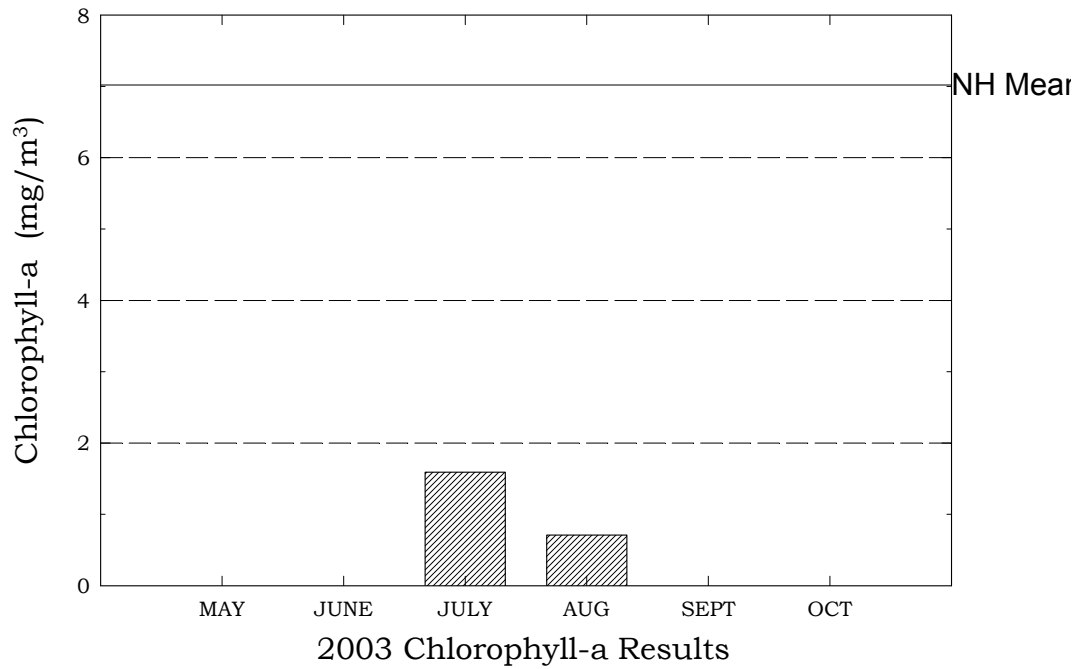
Lake Protection Tips: Some Do's and Don'ts for Maintaining Healthy Lakes, WD-BB-9, NHDES Fact Sheet, (603) 271-3503 or www.des.state.nh.us/factsheets/bb/bb-9.htm.

APPENDIX A

GRAPHS

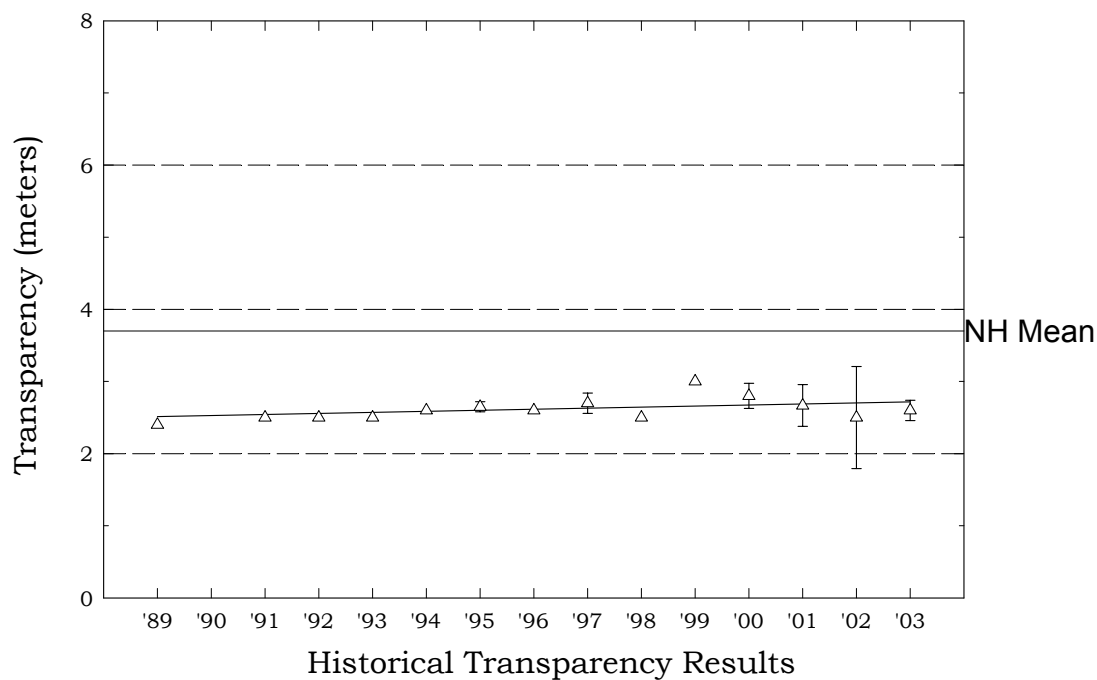
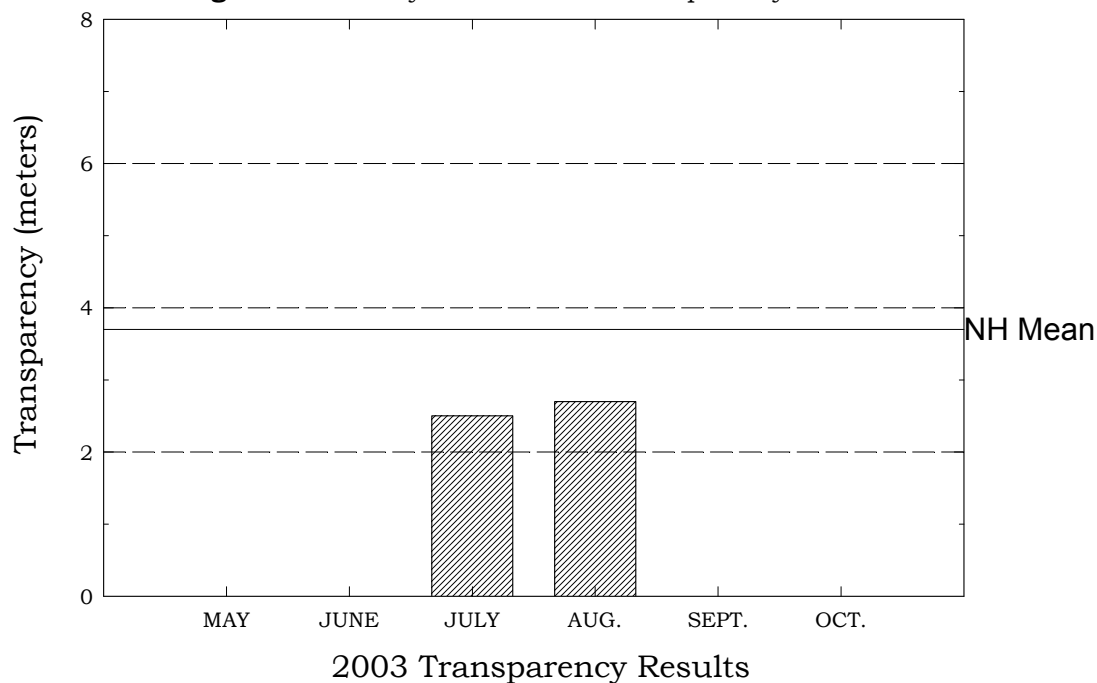
Dutchman Pond, Springfield

Figure 1. Monthly and Historical Chlorophyll-a Results



Dutchman Pond, Springfield

Figure 2. Monthly and Historical Transparency Results



Dutchman Pond, Springfield

Figure 3. Monthly and Historical Total Phosphorus Data.

